In the Specification

Replace the paragraph spanning pages 11, 12 and 13 as presented in the amendment dated August 18, 2003 as follows:

-- The CCD described above has the unique capability of detecting an input signal in the spectral range from about 3μm to 20μm by the mechanism of intersubband absorption. The energy band diagram of the device is shown in Fig. 3. It shows the quantum well and the current flows of charge carriers which may either fill the well or empty the well. The current flows into the well are the thermal emission from the modulation doped layer 163 to the left of the well, and the generation currents flowing toward the well(s) from the collector depletion layer consisting of the layers 170, 171,156, and 157 and from the quantum well(s) and barrier(s) which are layers 159 and 160 respectively. The currents flowing out of the well are the thermal emission current from the quantum well into the modulation doped layer 163 and the photocurrent from the quantum well into the modulation doped layer produced by the intersubband absorption in the quantum well. The other important current flow is the recombination current Jrb which allows electrons to flow from the modulation doped layer to the emitter contact (metal gate electrode 120) via electron-hole recombination current in the capacitor layer 164. During the operation as a photodetector, the gate electrode 120 is forward biased with respect to the collector contact layer 170/collector electrode 170A. This means that the capacitor layer 164 is forward biased and the collector contact layer 170 is reverse biased which enables the photocurrent to be conducted out of the system by forward bias and the dark current current flow (Jrbd) in the system to be controlled by the reverse bias across the collector contact layer 170. The operation of the photodetector is described as follows. The quantum well is initially filled substantially in the absence of light. A reasonable design is that the Fermi energy is above the first subband in the quantum well. Then the absorption will be maximized because it is proportional to the

number of electrons in the initial state. When long wavelength light is incident, then the photocurrent empties the quantum well. The dark current flowing into the well is produced by the generation current which is produced by emission across the energy gap of the quantum well or the barrier regions. The noise current $\underline{i_n}$ in the device which represents the limit to the detectable power is specified by the dark current I_d and it is $i_n^2 = 2qI_dB$ where q is the electronic charge and B is the bandwidth. In a conventional QWIP device, the dark current flows over a small barrier of a size comparable to the quantum well and therefore to obtain high background limited operation, it is necessary to cool the device to cryogenic temperatures of 50-60K in order to reduce I_d. Only at these temperatures can the shot noise associated with the dark current be reduced to a level that is comparable to the noise associated with the black body radiation from the scene at a temperature of 300K. --